

CLAIM

Having thus described the invention we claim as new and desire to secure by Letters Patent:

1 1. An electrically conductive polymer blend composition comprising the reaction product of an electrically conductive polymer in undoped form and a polydopant.

1 2. The electrically conductive polymer blend composition defined in claim 1 wherein said polymers interact at a plurality of sites along the length of said polymer thereby resulting in a molecularly compatible blend.

1 3. The electrically conductive polymer blend composition defined in claim 2 wherein said electrically conducting polymer complexes with said polydopant.

1 4. The electrically conductive polymer blend composition defined in claim 3 wherein one of said polymers is a rigid polymer.

1 5. The electrically conductive polymer blend composition defined in claim 3 wherein said electrically conductive polymer is selected from the group consisting of substituted and unsubstituted polyparaphenylenevinylenes, polyanilines, polyazazines, polythiophenes, poly-p-phenylene sulfides, polyfuranes,

6 polypyrroles, polyselenophenes, polyacetylenes formed
7 from soluble precursors and combinations and blends
8 thereof.

1 6. The electrically conductive polymer blend
2 composition defined in claim 5 wherein said polydopant is
3 a dielectric polymer containing Lewis acid functionality.

1 7. The electrically conductive polymer blend
2 composition defined in claim 6 wherein said Lewis acid
3 functionality reacts with said electrically conductive
4 polymer in undoped form to convert said conducting
5 polymer to the doped form.

1 8. The electrically conductive polymer blend
2 composition defined in claim 7 wherein said polydopant is
3 selected from the group consisting of polyacrylic acids,
4 polysulfonic acid, cellulose sulfonic acid, polyamic
5 acid, polyphosphoric acid, polymers containing acid
6 chloride groups (-CO-Cl) and polymers containing sulfonyl
7 chloride groups (-SO₂Cl).

1 9. The electrically conductive polymer blend
2 composition defined in claim 8 wherein said polydopant is
3 polyamic acid that is photosensitive.

1 10. The electrically conductive polymer blend
2 composition defined in claim 8 wherein said electrically
3 conductive polymer is polyaniline and said polydopant is

4 polyamic acid.

1 11. The electrically conductive polymer blend
2 composition defined in claim 8 wherein said electrically
3 conductive polymer is polythiophene and said polydopant
4 is a polyacrylic acid.

1 12. The electrically conductive polymer blend
2 composition defined in claim 8 that is in form of a gel.

1 13. The electrically conductive polymer blend
2 composition defined in claim 8 that is formed into a
3 shaped article.

1 14. The electrically conductive polymer blend
2 composition defined in claim 13 wherein the shaped arti-
3 cle is a fiber.

1 15. An electrically conducting polymer blend
2 composition comprising an electrically conductive polymer
3 in undoped form, a dielectric polymer and a thermally
4 deblockable dopant.

1 16. The electrically conducting polymer blend
2 composition defined in claim 15 wherein said electrically
3 conductive polymer is selected from the group consisting
4 of substituted and unsubstituted polyparaphen-
5 lenevinylenes, polyanilines, polyazines, polythiophenes,
6 poly-p-phenylene sulfides, polyfuranes, polypyrroles,
7 polyselenophenes, polyacetylenes formed from soluble

8 precursors and combinations and blends thereof.

1 17. The electrically conducting polymer blend
2 composition defined in claim 15 wherein said dielectric
3 polymer is selected from the group consisting of inter-
4 polymers of acrylonitrile-butadiene-styrene, acetal
5 acrylic liquid crystal polymers, polybutylene terephtha-
6 late, polycarbonate, polyester, polyetherimide,
7 polyethersulfone, polyethylene, polyethylene terephtha-
8 late, polyphenylene oxide polyphenylene sulfide,
9 polypropylene, polystyrene, polyurethane, polyvinyl
10 chloride, styrene-acrylonitrile copolymer fluoropolymers,
11 nylon polyesters and thermoplastic elastomer.

1 18. The electrically conducting polymer blend
2 composition defined in claim 15 wherein said thermally
3 deblockable dopants are selected from the group consist-
4 ing of triflates, tosylates and borates.

1 19. The electrically conducting polymer blend
2 composition defined in claim 15 wherein said triflates,
3 tosylates and borates are selected from the group con-
4 sisting of $\text{CF}_3\text{SO}_3\text{H NC}_5\text{H}_5$, $\text{CF}_3\text{SO}_3\text{H}\cdot\text{NH}_3$, $\text{CF}_3\text{SO}_3\text{H}\cdot\text{CH}_3\text{NHC}$,
5 $\text{CF}_3\text{SO}_3\text{H}\cdot(\text{CH}_3)_3\text{N}$, $\text{CF}_3\text{SO}_3\text{H}\cdot\text{C}_2\text{H}_5\text{NH}_2$, $\text{CF}_3\text{SO}_3\text{H}\cdot(\text{C}_2\text{H}_5)_2\text{NH}$,
6 $\text{CF}_3\text{SO}_3\text{H}\cdot(\text{C}_2\text{H}_5)_3\text{N}$, $\text{CF}_3\text{SO}_3\text{H}\cdot(\text{i - C}_3\text{H}_7)_2\text{NH}$, $\text{CF}_3\text{SO}_3\text{H}\cdot(\text{i - C}_3\text{H}_7)_2\text{N}(\text{C}_2\text{H}_5)$,
7 $\text{CF}_3\text{SO}_3\text{H}\cdot(\text{i - C}_3\text{H}_7)_2\text{N}(\text{C}_2\text{H}_4\text{OH})$,
8 $\text{CF}_3\text{SO}_3\text{H}\cdot\text{H}_2\text{N}(\text{C}_2\text{H}_4\text{OH})$, $\text{CF}_3\text{SO}_3\text{H}\cdot\text{HNC}_4\text{H}_8\text{O}$,

9 $\text{CF}_3\text{SO}_3\text{H} \cdot \text{H}_2\text{NC}(\text{CH}_3)_2\text{CH}_2\text{OH}$, $\text{CF}_3\text{SO}_3\text{H} \cdot \text{HNC}_5\text{H}_{10}$,
10 $\text{CF}_3\text{SO}_3\text{H} \cdot \text{HN}(\text{C}_2\text{H}_4\text{OH})_2$, $\text{BF}_3\text{C}_2\text{H}_5\text{NH}_2$, $\text{CF}_3\text{SO}_3(\text{CH}_3)_4\text{N}$,
11 $\text{H}_3\text{C}(\text{C}_6\text{H}_4)\text{SO}_3\text{H}$.

1 20. The electrically conducting polymer blend
2 composition defined in claim 15 wherein said dielectric
3 polymer is selected from the group consisting of inter-
4 polymers of acrylonitrile-butadiene-styrene, acetal
5 acrylic liquid crystal polymers, polybutylene terephtha-
6 late, polycarbonate, polyester, polyetherimide,
7 polyethersulfone, polyethylene, polyethylene terephtha-
8 late, polyphenylene oxide, polyphenylene sulfide,
9 polypropylene, polystyrene, polyurethane, polyvinyl
10 chloride, styrene-acrylonitrile copolymer and
11 thermoplastic elastomer; and said thermally deblockable
12 dopants are selected from the group consisting of
13 $\text{CF}_3\text{SO}_3\text{H} \cdot \text{NC}_5\text{H}_5$, $\text{CF}_3\text{SO}_3\text{H} \cdot \text{NH}_3$, $\text{CF}_3\text{SO}_3\text{H} \cdot \text{CH}_3\text{NHC}$,
14 $\text{CF}_3\text{SO}_3\text{H} \cdot (\text{CH}_3)_3\text{N}$, $\text{CF}_3\text{SO}_3\text{H} \cdot \text{C}_2\text{H}_5\text{NH}_2$, $\text{CF}_3\text{SO}_3\text{H} \cdot (\text{C}_2\text{H}_5)_2\text{NH}$,
15 $\text{CF}_3\text{SO}_3\text{H} \cdot (\text{C}_2\text{H}_5)_3\text{N}$, $\text{CF}_3\text{SO}_3\text{H} \cdot (\text{i} - \text{C}_3\text{H}_7)_2\text{NH}$, $\text{CF}_3\text{SO}_3\text{H} \cdot (\text{i} -$
16 $\text{C}_3\text{H}_7)_2\text{N}(\text{C}_2\text{H}_5)$, $\text{CF}_3\text{SO}_3\text{H} \cdot (\text{i} - \text{C}_3\text{H}_7)_2\text{N}(\text{C}_2\text{H}_4\text{OH})$,
17 $\text{CF}_3\text{SO}_3\text{H} \cdot \text{H}_2\text{N}(\text{C}_2\text{H}_4\text{OH})$, $\text{CF}_3\text{SO}_3\text{H} \cdot \text{HNC}_4\text{H}_8\text{O}$,
18 $\text{CF}_3\text{SO}_3\text{H} \cdot \text{H}_2\text{NC}(\text{CH}_3)_2\text{CH}_2\text{OH}$, $\text{CF}_3\text{SO}_3\text{H} \cdot \text{HNC}_5\text{H}_{10}$,
19 $\text{CF}_3\text{SO}_3\text{H} \cdot \text{HN}(\text{C}_2\text{H}_4\text{OH})_2$, $\text{BF}_3\text{C}_2\text{H}_5\text{NH}_2$, $\text{CF}_3\text{SO}_3(\text{CH}_3)_4\text{N}$,
20 $\text{H}_3\text{C}(\text{C}_6\text{H}_4)\text{SO}_3\text{H}$.

1 21. The electrically conducting polymer blend

2 composition defined in claim 20 wherein said electrically
3 conductive polymer is polyaniline, said dielectric
4 polymer is polycarbonate and said thermally deblockable
5 dopant is diethylamine triflate.

1 22. The electrically conducting polymer blend
2 composition defined in claim 20 wherein the electrically
3 conductive polymer is polythiophene said dielectric
4 polymer is nylon and said thermally deblockable dopant is
5 $\text{CF}_3\text{SO}_3\text{H} \cdot \text{H}_2\text{N}(\text{C}_2\text{H}_4\text{OH})$.

1 23. The electrically conductive polymer blend
2 composition comprising: a frustrated blend of polyimide
3 and an electrically conductive polymer selected from the
4 group consisting of substituted and unsubstituted
5 polyparaphenylenevinylenes, polyanilines, polyazines,
6 polythiophenes, poly-p-phenylene sulfides, polyfuranes,
7 polypyrroles, polyselenophenes, polyacetylenes formed
8 from soluble precursors and combinations and blends
9 thereof.

1 24. A conductive shaped article comprising:
2 a doped electrically conductive polymer
3 material in admixture with a dielectric polymer material.
4 25. The shaped article defined in claim 24,
5 wherein said electrically conductive polymer material is
6 in the form of a fiber.

1 26. The shaped article defined in claim 24,
2 wherein said body is selected from the group consisting
3 of a crystalline solid, an amorphous solid, a
4 polycrystalline solid a semicrystalline solid and a
5 glass.

1 27. The shaped article defined in claim 24 fur-
2 ther including an anion of a doping agent.

3 28. The shaped article defined in claim 24,
4 wherein said dielectric polymer material is an anion of
5 polymeric carboxylic acid.

1 29. The shaped article defined in claim 24 that
2 has been shaped into a stylus suitable for use in resis-
3 tive film digitizer.

1 30. A method comprising: providing a shaped ar-
2 ticle of the material of claim 24, thereupon applying a
3 bias thereto to deposit another composition thereon using
4 a method selected from the group consisting of elec-
5 trostatic and electrochemical deposition.

1 31. A method of preparing an electrically con-
2 ductive intercalated molecular polymer blend composition
3 comprising blending a polydopant with a conducting
4 polymer in undoped form, to obtain a uniform dispersion
5 at a molecular scale as a result of an interaction along
6 the length of said polymer.

1 32. The method of preparing the electrically
2 conductive polymer blend defined in claim 31, wherein
3 said polydopant is a Lewis acid polymer.

1 33. The method of preparing the electrically
2 conductive polymer blend defined in claim 32, wherein
3 said Lewis acid polymer is selected from the group con-
4 sisting of polymeric acid, polysulfonic acid, cellulose
5 sulfonic acid, polyamic acid, photosensitive polyamic
6 acid, polyphosphoric acid, acid chloride containing
7 polymers and sulfonyl chloride containing polymers.

1 34. The method of preparing the electrically
2 conductive polymer blend defined in claim 31, wherein
3 said conducting polymer is selected from the group con-
4 sisting of substituted and unsubstituted
5 polyparaphenylenevinylenes, polyanilines, polyazines,
6 polythiophenes, poly-p-phenylene sulfides, polyfuranes,
7 polypyrroles, polyselenophenes, polyacetylenes formed
8 from soluble precursors and combinations and blends
9 thereof.

1 35. The method of preparing the electrically
2 conductive polymer blend defined in claim 34, wherein
3 said Lewis acid polymer is selected from the group con-
4 sisting of polymeric acid, polysulfonic acid, cellulose
5 sulfonic acid polyamic acid, photosensitive polyamic

6 acid, polyphosphoric acid, acid chloride containing
7 polymers and sulfonyl chloride containing polymers.

1 36. The method of preparing the electrically
2 conductive polymer blend defined in claim 35, wherein the
3 conducting polymer is polyanilene and said Lewis acid
4 polymer is polyamic acid.

1 37. A method of preparing the electrically con-
2 ducting polymer system comprising blending a conductive
3 polymer in undoped form with a dielectric polymer and a
4 thermally deblockable dopant, and heating said blend to
5 obtain a conductive blend.

1 38. The method of preparing the electrically
2 conductive polymer system defined in claim 37, wherein
3 said electrically conductive polymer is selected from the
4 group consisting of substituted and unsubstituted
5 polyparaphenylenevinylenes, polyanilines, polyazines,
6 polythiophenes, poly-p-phenylene sulfides, polyfuranes,
7 polypyrroles, polyselenophenes, polyacetylenes formed
8 from soluble precursors and combinations and blends
9 thereof.

1 39. The method of preparing the electrically
2 conductive polymer system defined in claim 37, wherein
3 said dielectric polymer is selected from the group con-
4 sisting of interpolymers of acrylonitrile-butadiene-

5 styrene, acetal acrylic liquid crystal polymers,
6 polybutylene terephthalate, polycarbonate, polyester,
7 polyetherimide, polyethersulfone, polyethylene,
8 polyethylene terephthalate, polyphenylene oxide
9 polyphenylene sulfide, polypropylene, polystyrene,
10 polyurethane, polyvinyl chloride, styrene-acrylonitrile
11 copolymer and thermoplastic elastomer.

1 40. The method of preparing the electrically
2 conductive polymer system defined in claim 37, wherein
3 said thermally deblockable dopant is selected from the
4 group consisting of triflates, tosylates and borates.

1 41. The method of preparing the electrically
2 conductive polymer system defined in claim 39, wherein
3 said triflates, tosylates and borates are selected from
4 the group consisting of $\text{CF}_3\text{SO}_3\text{H NC}_5\text{H}_5$, $\text{CF}_3\text{SO}_3\text{H}\cdot\text{NH}_3$,
5 $\text{CF}_3\text{SO}_3\text{H}\cdot\text{CH}_3\text{NHC}$, $\text{CF}_3\text{SO}_3\text{H}\cdot(\text{CH}_3)_3\text{N}$, $\text{CF}_3\text{SO}_3\text{H}\cdot\text{C}_2\text{H}_5\text{NH}_2$,
6 $\text{CF}_3\text{SO}_3\text{H}\cdot(\text{C}_2\text{H}_5)_2\text{NH}$, $\text{CF}_3\text{SO}_3\text{H}\cdot(\text{C}_2\text{H}_5)_3\text{N}$, $\text{CF}_3\text{SO}_3\text{H}\cdot(\text{i} -$
7 $\text{C}_3\text{H}_7)_2\text{NH}$, $\text{CF}_3\text{SO}_3\text{H}\cdot(\text{i} - \text{C}_3\text{H}_7)_2\text{N}(\text{C}_2\text{H}_5)$, $\text{CF}_3\text{SO}_3\text{H}\cdot(\text{i} -$
8 $\text{C}_3\text{H}_7)_2\text{N}(\text{C}_2\text{H}_4\text{OH})$, $\text{CF}_3\text{SO}_3\text{H}\cdot\text{H}_2\text{N}(\text{C}_2\text{H}_4\text{OH})$, $\text{CF}_3\text{SO}_3\text{H}\cdot\text{HNC}_4\text{H}_8\text{O}$,
9 $\text{CF}_3\text{SO}_3\text{H}\cdot\text{H}_2\text{NC}(\text{CH}_3)_2\text{CH}_2\text{OH}$, $\text{CF}_3\text{SO}_3\text{H}\cdot\text{HNC}_5\text{H}_{10}$,
10 $\text{CF}_3\text{SO}_3\text{H}\cdot\text{HN}(\text{C}_2\text{H}_4\text{OH})_2$, $\text{BF}_3\text{C}_2\text{H}_5\text{NH}_2$, $\text{CF}_3\text{SO}_3(\text{CH}_3)_4\text{N}$,
11 $\text{H}_3\text{C}(\text{C}_6\text{H}_4)\text{SO}_3\text{H}$.

1 42. The method of preparing the electrically
2 conductive polymer system defined in claim 38, wherein

3 said dielectric polymer is selected from the group con-
4 sisting of interpolymers of acrylonitrile-butadiene-
5 styrene, acetal acrylic liquid crystal polymers,
6 polybutylene terephthalate, polycarbonate, polyester,
7 polyetherimide, polyethersulfone, polyethylene,
8 polyethylene terephthalate, polyphenylene oxide,
9 polyphenylene sulfide, polypropylene, polystyrene,
10 polyurethane, polyvinyl chloride, styrene-acrylonitrile
11 copolymer and thermoplastic elastomer; and said thermally
12 deblockable dopants are selected from the group consist-
13 ing of $\text{CF}_3\text{SO}_3\text{H NC}_5\text{H}_5$, $\text{CF}_3\text{SO}_3\text{H} \cdot \text{NH}_3$, $\text{CF}_3\text{SO}_3\text{H} \cdot \text{CH}_3\text{NHC}$,
14 $\text{CF}_3\text{SO}_3\text{H} \cdot (\text{CH}_3)_3\text{N}$, $\text{CF}_3\text{SO}_3\text{H} \cdot \text{C}_2\text{H}_5\text{NH}_2$, $\text{CF}_3\text{SO}_3\text{H} \cdot (\text{C}_2\text{H}_5)_2\text{NH}$,
15 $\text{CF}_3\text{SO}_3\text{H} \cdot (\text{C}_2\text{H}_5)_3\text{N}$, $\text{CF}_3\text{SO}_3\text{H} \cdot (\text{i} - \text{C}_3\text{H}_7)_2\text{NH}$, $\text{CF}_3\text{SO}_3\text{H} \cdot (\text{i} -$
16 $\text{C}_3\text{H}_7)_2\text{N}(\text{C}_2\text{H}_5)$, $\text{CF}_3\text{SO}_3\text{H} \cdot (\text{i} - \text{C}_3\text{H}_7)_2\text{N}(\text{C}_2\text{H}_4\text{OH})$,
17 $\text{CF}_3\text{SO}_3\text{H} \cdot \text{H}_2\text{N}(\text{C}_2\text{H}_4\text{OH})$, $\text{CF}_3\text{SO}_3\text{H} \cdot \text{HNC}_4\text{H}_8\text{O}$,
18 $\text{CF}_3\text{SO}_3\text{H} \cdot \text{H}_2\text{NC}(\text{CH}_3)_2\text{CH}_2\text{OH}$, $\text{CF}_3\text{SO}_3\text{H} \cdot \text{HNC}_5\text{H}_{10}$,
19 $\text{CF}_3\text{SO}_3\text{H} \cdot \text{HN}(\text{C}_2\text{H}_4\text{OH})_2$, $\text{BF}_3\text{C}_2\text{H}_5\text{NH}_2$, $\text{CF}_3\text{SO}_3(\text{CH}_3)_4\text{N}$,
20 $\text{H}_3\text{C}(\text{C}_6\text{H}_4)\text{SO}_3\text{H}$.

1 43. The method of preparing the electrically
2 conducting polymer blend defined in claim 35 wherein the
3 blend is formed into a conductive gel in dilute solution
4 which is formed into a shaped article.

1 44. The method of preparing the electrically
2 conducting polymer system defined in claim 35 wherein

3 said blend is processed in the solid state.

45. The method defined in claim 43 wherein said shaped article is a fiber.

1 46. The method defined in claim 43 wherein said
2 shaped article is a film.

1 47. The method defined in claim 43 wherein said
2 shaped article is a body. 1

1 48. A method comprising applying a conducting
2 polymer to the surface of a non conducting shaped arti-
3 cle.

1 49. The method defined in claim 48 wherein said
2 conducting polymer is solution deposited.

1 50. The method defined in claim 48 wherein said
2 conducting polymer is vapor deposited.

1 51. The method defined in claim 48 wherein said
2 conducting polymer is electrochemically deposited.

1 52. The method defined in claim 48 wherein said
2 conducting polymer is deposited by adsorption.

Diagram illustrating the addition of various components:

- Top Left: Add a
- Top Right: Add $e_1 + e_2$
- Middle Left: Add DS
- Middle Right: Add G_{12}
- Bottom Left: Add G_{13}
- Bottom Right: Add G_{23}